In Fig. 4, plotted are the data of the Comparative Cases 1 to 4 mentioned above and those of Example 1 to be mentioned in detail hereunder. In the Synthetic AF structure, where the magnetic thickness of the pinned film adjacent to the spacer is larger than that of the other pinned film, the magnetic thickness of the pinned layer in the horizontal axis is in the plus side in the graph of Fig. 4; and where the magnetic thickness of the pinned film adjacent to the spacer is smaller than that of the other pinned film, the magnetic thickness of the pinned layer in the horizontal axis is in the minus side. In the conventional pin layer constitution with no Synthetic AF, the magnetic thickness of the pinned layer is all in the plus side.

As is known from Fig. 4, the films of the Comparative Cases are all outside the preferred range, or that is, their bias points are not good and their asymmetry is large; but those of the invention all within the preferred range, or that is, their bias points are all good and their asymmetry is small.

Examples of concrete film structures of the invention are mentioned below, in which the small Hpin in Synthetic AF is canceled by the small Hcu to realize Hpin - Hin = Hcu through specific bias point designing and the difficulties in improving the thermal stability for MR ratio that is peculiar to ultra-thin free layer-incorporated spin valve films are overcome.

Example 1: Top SFSV (with free layer of NiFe/Co(Fe))

5 nanometer Ta/x nm Cu/2 nm NiFe/0.5 nm CoFe/2 nm Cu/(2+y) nm CoFe/0.9 nm Ru/2 nm CoFe/ 7 nm IrMn/5 nanometer Ta

(7-1)

This is to exemplify a so-called top-type spin valve film in which an antiferromagnetic layer is above a free layer.

Fig. 5 is a conceptual view showing a typical film constitution of the magnetoresistance effect device of this Example. Precisely, the device illustrated comprises a high-conductivity layer 101 peculiar to the invention, a free layer 102 and a spacer layer 103 all laminated on a subbing buffer layer 112 in that order, and comprises pinned ferromagnetic layers 104 and 106 as antiferromagnetically coupled to each other via a layer 105, in which the layer 106 is pinned in one direction by an antiferromagnetic layer 107. On the antiferromagnetic layer 107, formed is a cap layer 113. In the film structure of (7-1), the free layer 102 is of a laminate film composed of two layers 110 and 111, and the nonmagnetic high-conductivity layer 101 is a single layer of Cu.

The film (7-1) has achieved both good MR and good bias point control, owing to the MR spin filter effect of the subbing Cu layer and to the effect of the Synthetic AF structure to reduce Hpin. The bias point data for the film, as calculated according to the method mentioned above, are in Table 5.

Table 5

Calculated Bias Point Data

(a) y = 0.5, Hin = 20 Oe

| MR height | x = 2 |
|---|---|
| 0.3 μm | 37 % |
| 0.5 μm | 31 % |
| 0.7 μm | 25 % |

(b) y = 0.8, Hin = 20 Oe

| MR height | x = 2 |
|---|---|
| 0.3 μm | 46 % |
| 0.5 μm | 40 % |
| 0.7 μm | 33 % |

(c) y = 0.5, Hin = 10 Oe

| MR height | x = 2 |
|---|---|
| 0.3 μm | 42 % |
| 0.5 μm | 39 % |
| 0.7 μm | 36 % |

The subbing Cu layer has a thickness of 2 nanometers. In the structure where the underlayer is a simple, single-layered, high-conductivity layer of Cu, Hin is 20 Oe and is relatively large. In that structure, it is known from the data of Table 5-(a) where the difference in the thickness between the upper and lower pinned layers in the Synthetic AF is 0.5 nanometers, that the bias points are shifted to the minus side in some degree from the good bias point of 40 %. The film with